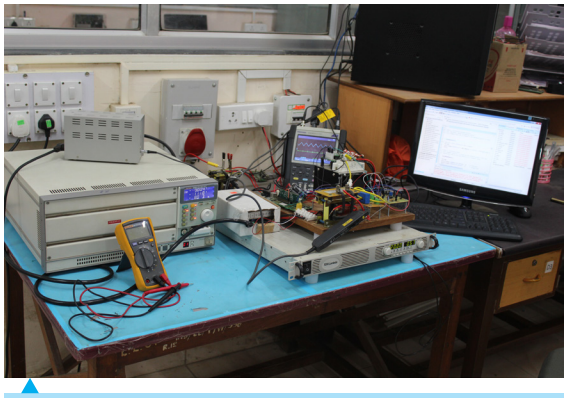
Intelligent microgrid with appropriate energy storage

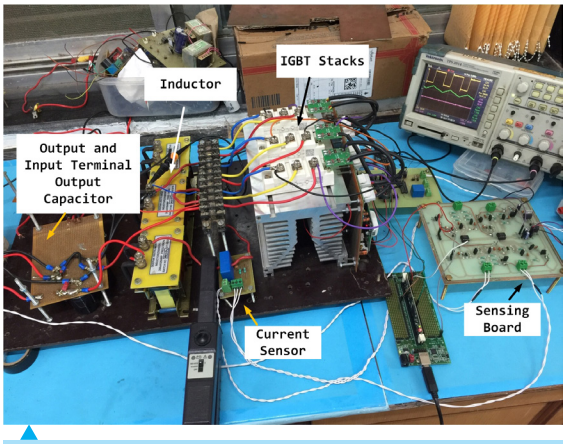
Microgrid is a power pool in which a number of generating sources, storage devices and loads are interconnected with each other to exchange power. A load survey was carried out in the IIT Bombay campus to determine the load profile of the campus school, a residential building, an elevator system and the hospital. The objective of the project is to design an AC-DC hybrid microgrid to meet various load profiles, taking the Institutes's campus as an example.

Three operating modes of the microgrid are considered: grid dependent, grid independent and grid back up. Actual hardware prototypes are built and tested with the emulated loads. The controllers for regulating power from various sources like solar PV, battery, ultracapacitor, fuel cell, and interlinking inverter are designed. A strategy based on fuzzy logic controller is proposed to control the power from the ultracapacitor, which results in improved transient response and tight regulation of the DC bus voltage.

Another scheme is developed for hydrogen storage using an electrolyser and fuel cell. The ultra-capacitor is also incorporated along with fuel cell and electrolyser to improve the transient response and DC bus voltage regulation. The microgrid has been tested upto a power rating of 2 kW.



Hardware prototype of a typical DC load



Prototype of a voltage regulating converter

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